



**SIEMENS**

# Lifecycle Energy Modeling Input into Upstream Design Process

Prasanth Chandrahasan  
Senior Consultant  
Siemens Energy Inc.  
Oil and Gas Division

CO<sub>2</sub> Summit: Technology and Opportunity

6-10 June 2010, Vail CO USA

© Siemens AG 2010. All rights reserved.

## Agenda

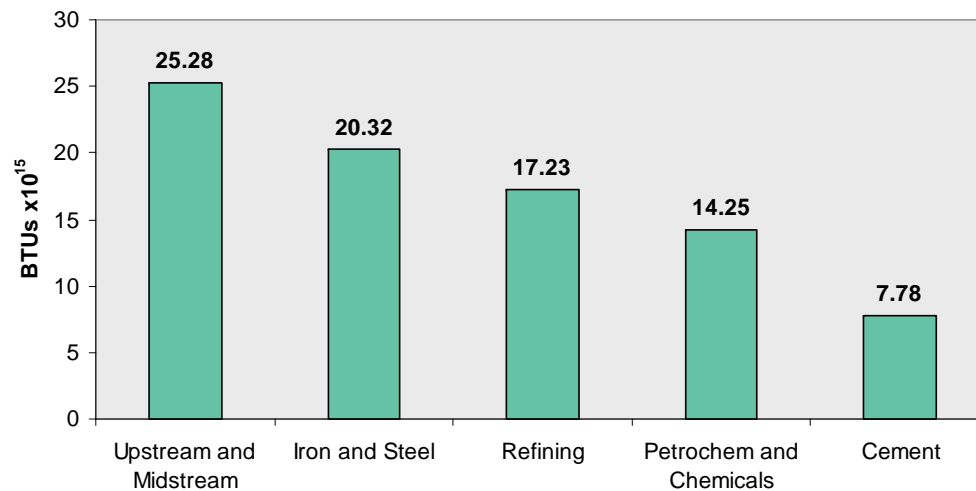
Background	energy usage profile of upstream industry upstream conceptual design process typical conceptual design case generation
Design input	production profile valuation methods
Comparison	energy intensity vs. production CO <sub>2</sub> emissions vs. production availability model output
Conclusion	net savings achieved – life cycle net savings achieved – totals questions

## Background

### Energy usage profile of upstream industry

SIEMENS

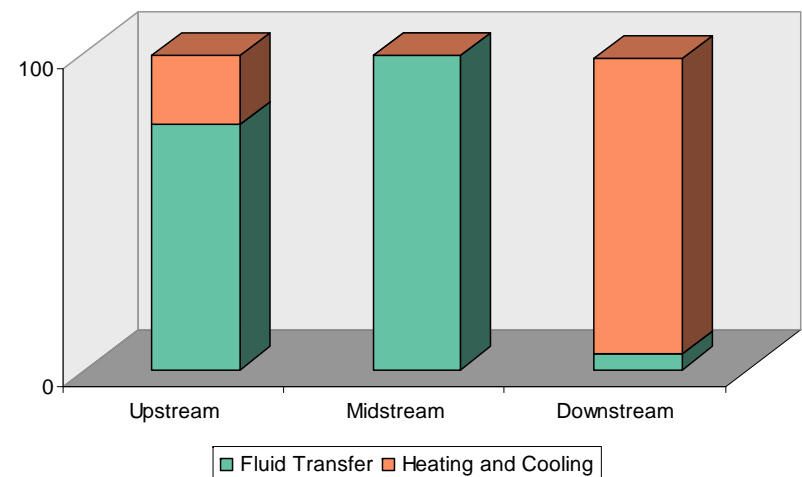
Top Energy Intensive Industries (worldwide, 2005)



Oil and gas is top industrial energy user

Upstream use primarily in pumping/compression

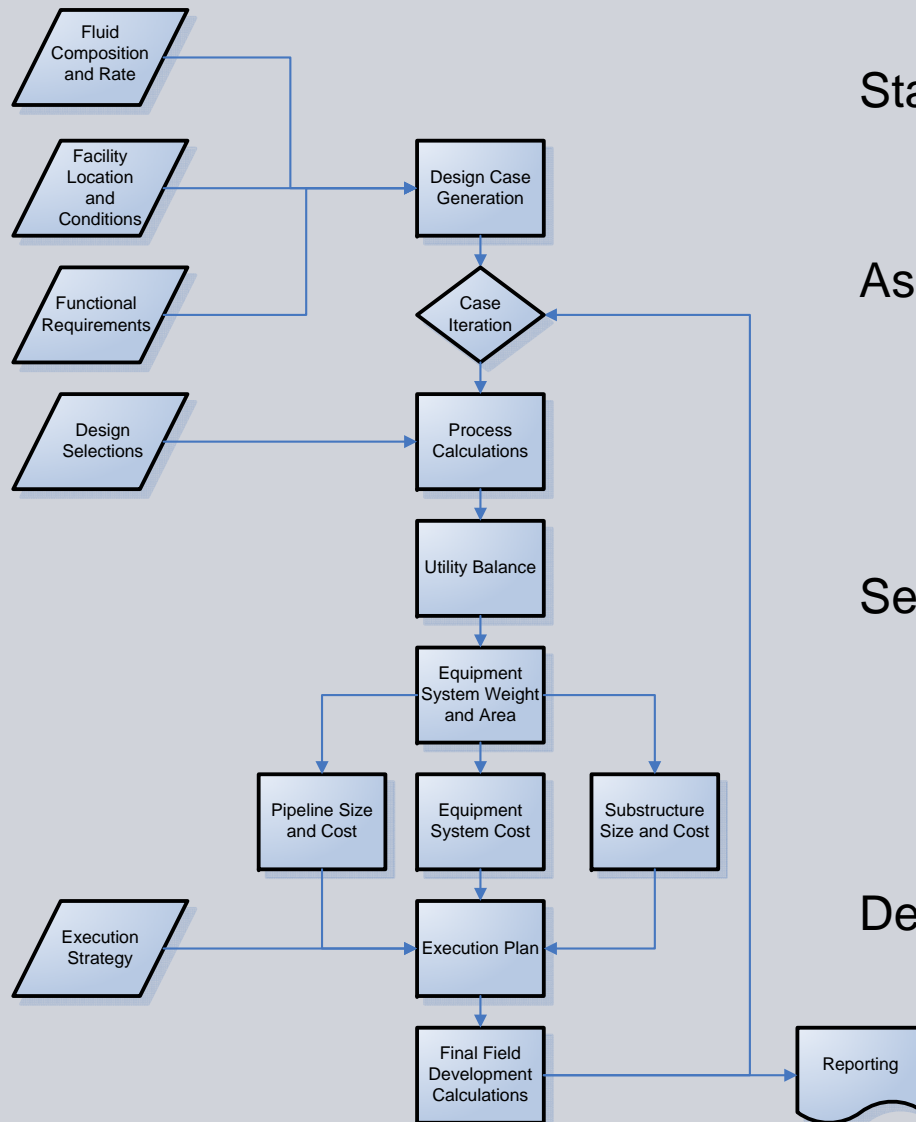
Energy Usage Distribution



# Background

## Typical facility conceptual design process

SIEMENS



Stage gate process  
method of capital appropriation

Assess phase (0.1% of project capital)  
develop concept design cases  
generate high level definition  
target +/-50% cost estimate

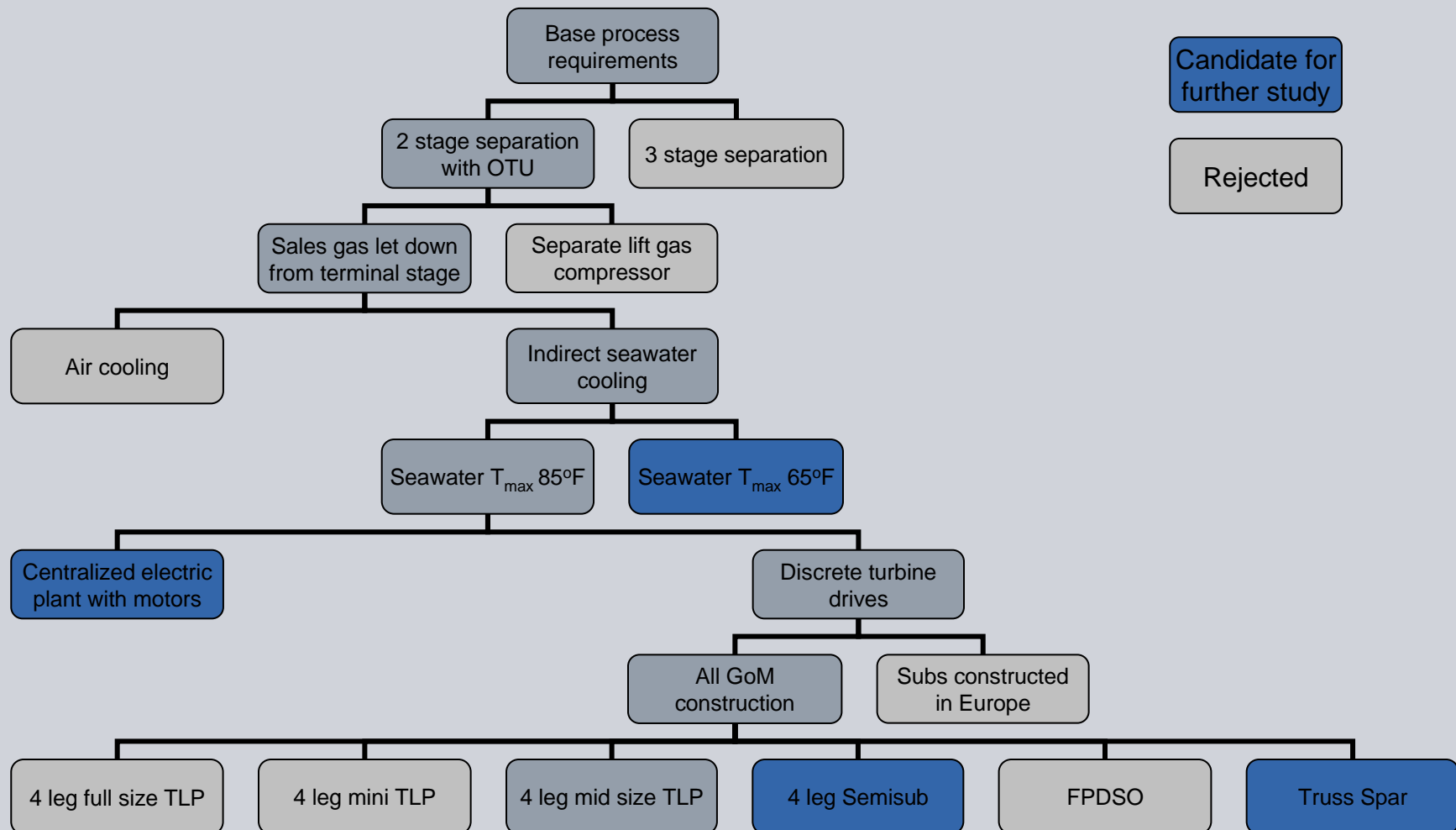
Select phase (1% of project capital)  
refine and select base case  
front end engineering work  
target +/-30% cost estimate

Define phase (10% of project capital)  
detailed engineering  
target +/-10% cost estimate

# Background

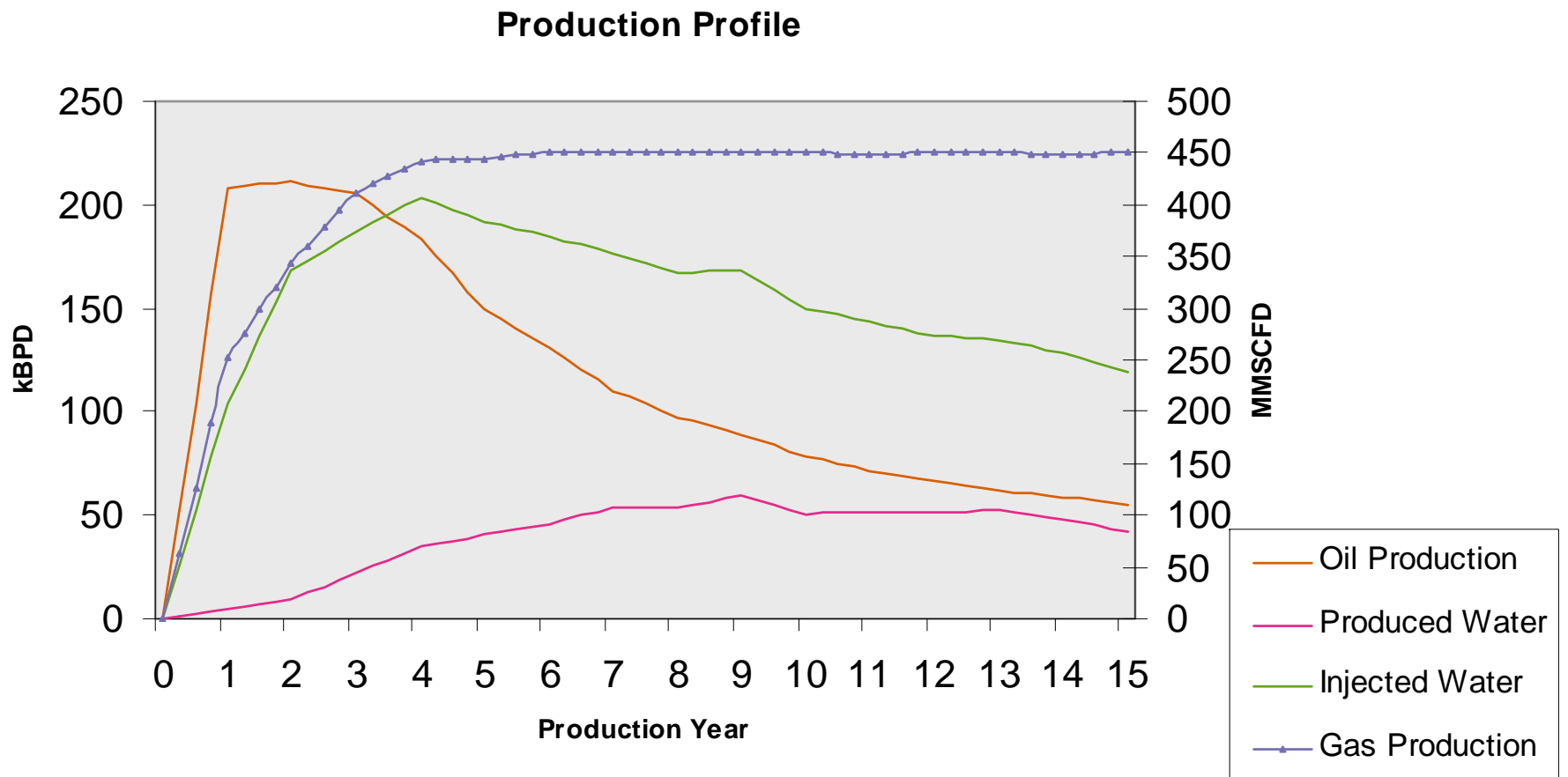
## Typical concept design case generation

SIEMENS



## Design input Production profile

SIEMENS



## Design input

### Valuation methods

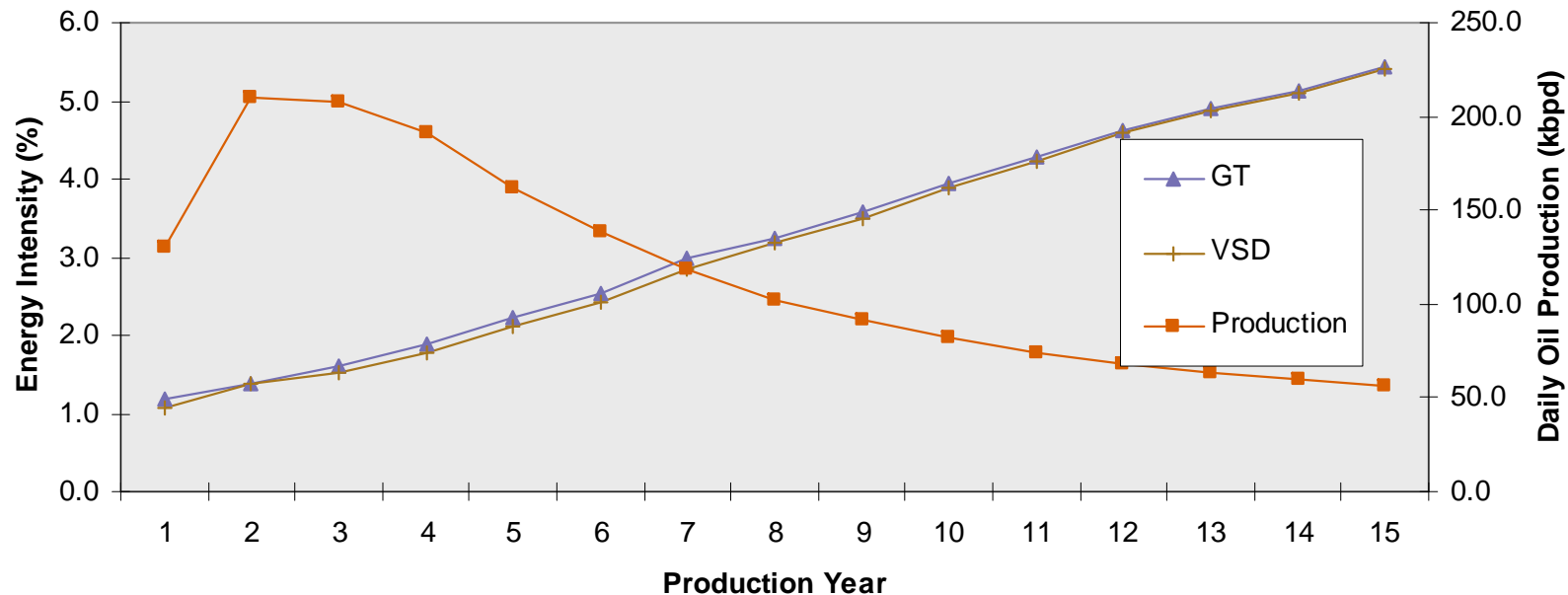


Fuel usage	cost avoidance of fines associated with flaring discounted NPV assuming future local gas market average pricing for recent gas sales or fraction thereof 2009 average wellhead gas price \$3.71/kscf
CO <sub>2</sub> emissions	primarily cost avoidance of emissions taxes possible offsets market for international companies discounted NPV for countries with future requirements EUA December 2010 contract was €15.10/ton CO <sub>2</sub> (5/28/2010)
Availability	calculate actual production time out of service use production pricing and profile for value compare NPV for base output and for increased availability NPV difference is value of deferred production Brent spot was \$72.40/bbl (5/28/2010)
Inflation	2.5% annually

# Comparison Energy intensity vs. production

SIEMENS

Annual Average Energy Intensity vs. Production

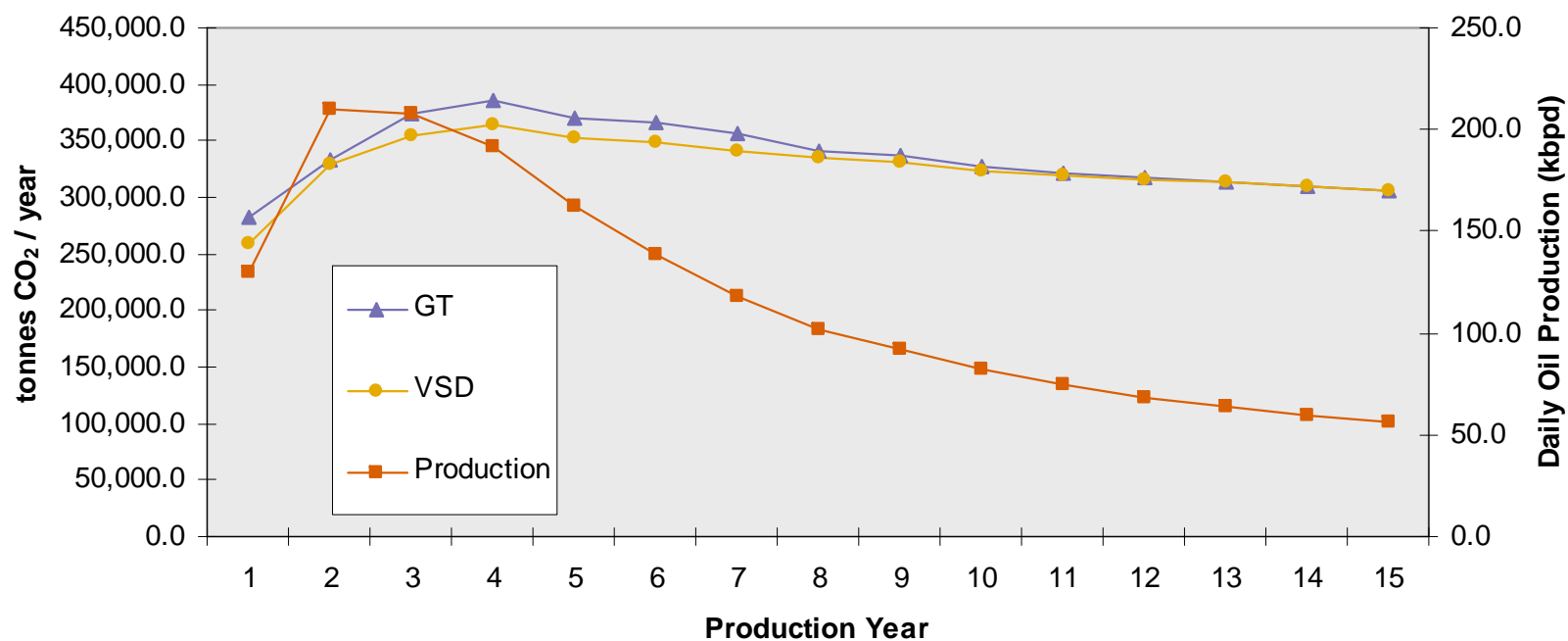




# Comparison CO<sub>2</sub> emissions vs. production

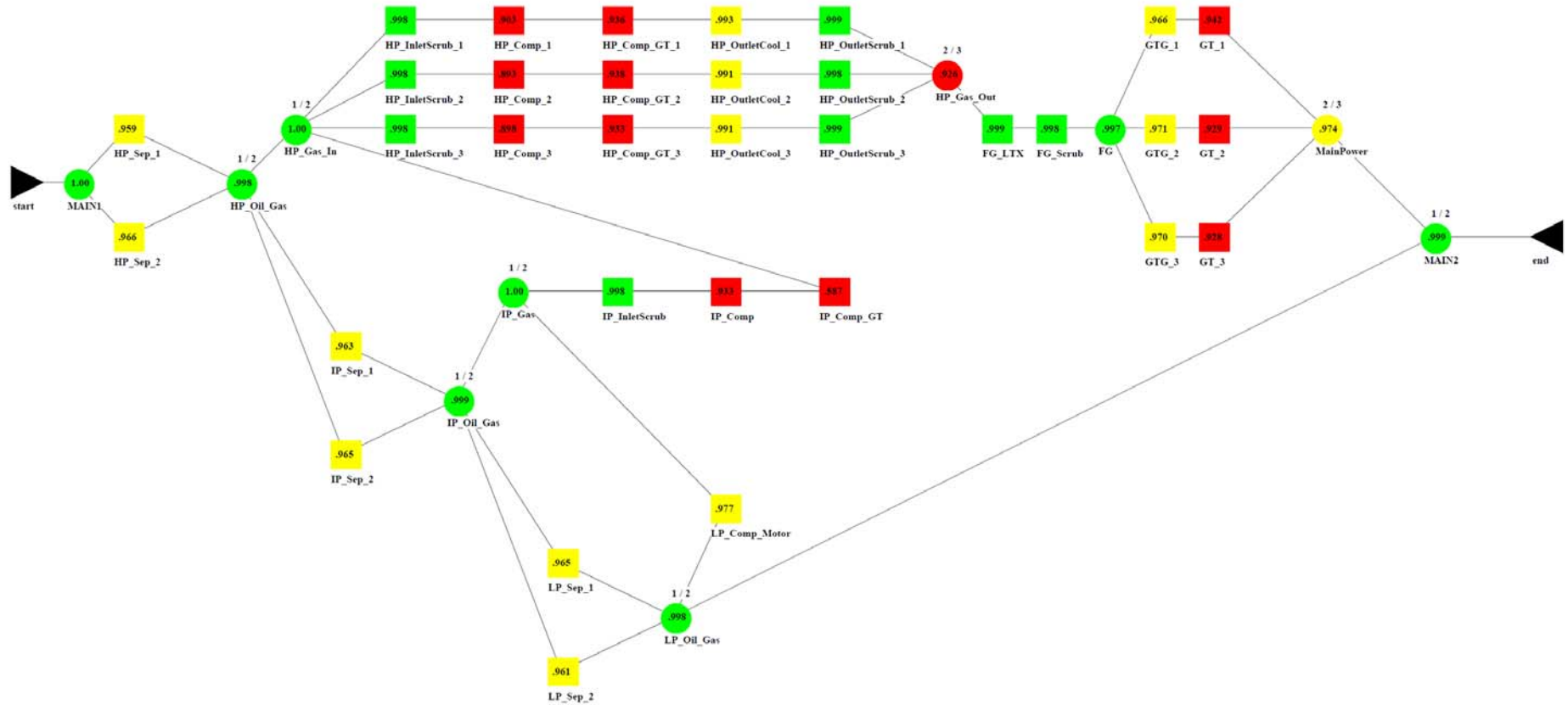
SIEMENS

CO<sub>2</sub> Emissions vs. Production



# Comparison Availability model

SIEMENS

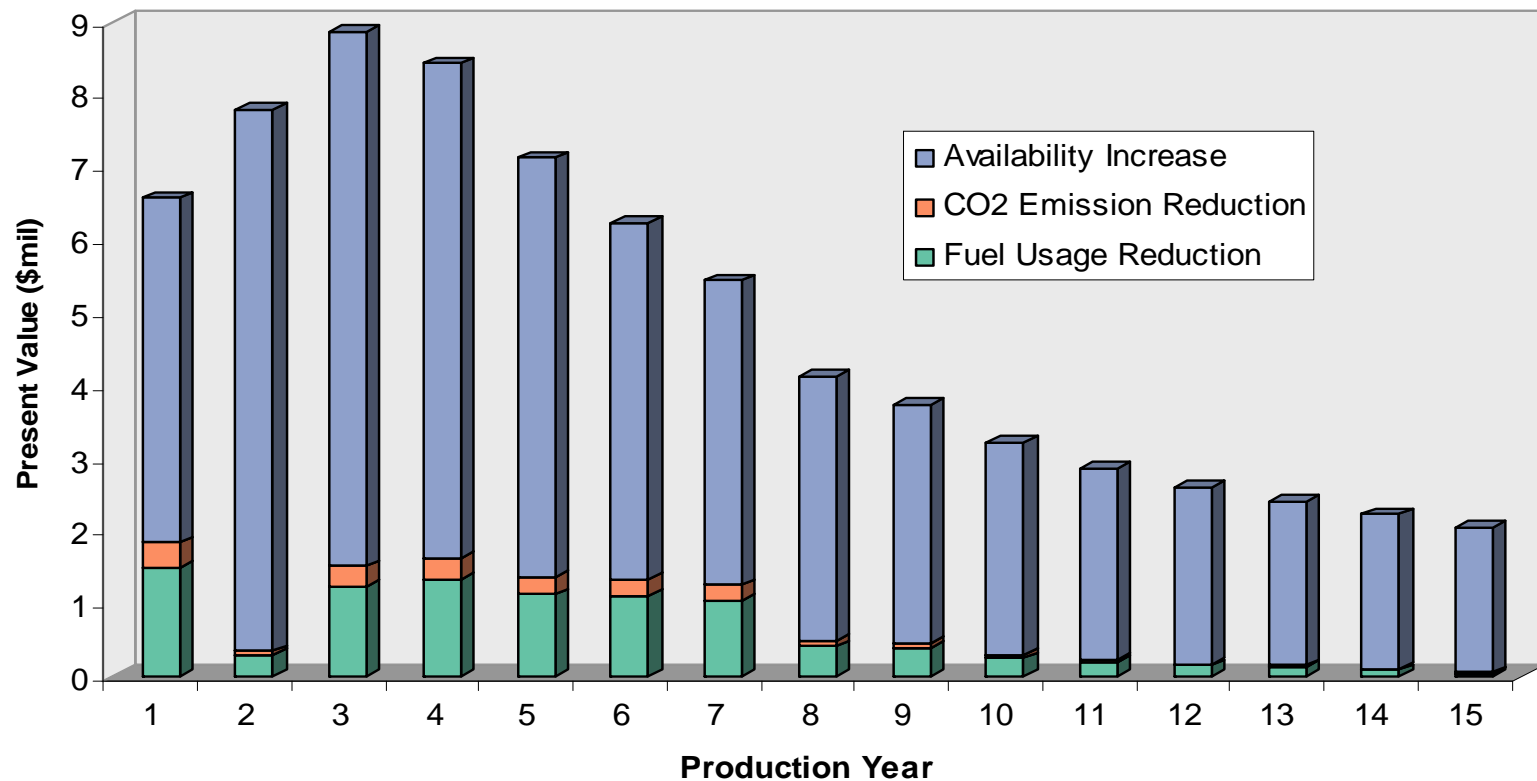


## Conclusion

### Net savings achieved, life cycle



Constituent Values of Life Cycle NPV Savings (VSD vs. GT)



## Conclusion

### Net savings achieved, totals



	GT	VSD
CAPEX (total platform installed cost)	1,149,163,400	1,183,251,600
		(34,088,200)

NPV OPEX savings for fuel gas	9,304,509
NPV OPEX savings for emissions	1,925,837
NPV OPEX savings for uptime	62,315,457
Total NPV savings	73,545,804

Overall savings	39,457,604
-----------------	------------

**SIEMENS**

**Questions?**

